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2015

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MPRA Paper No. 68364, posted 14. December 2015 17:44 UTC

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Abstract

Approaches based on Social Accounting Matrices (SAMs) and Socio-Demographic Matrices (SDMs) will be presented as a way of capturing relevant networks of linkages and the corresponding multiplier effects, which can subsequently be used for modelling the activity of the countries to be studied. Emphasis will be placed on the activity of household unincorporated enterprises, also known as informal enterprises.

Based on methodological principles derived mainly from the works of Richard Stone, this study will be developed in a matrix format, including, on the one hand, people – represented by a SDM – and, on the other hand, activities, products, factors of production and institutions – represented by a SAM. The exposition will be accompanied by an application to Portugal, in which different scenarios will be briefly presented, involving changes in incomes and expenditures. The macroeconomic effects of these changes will be summarised in the form of changes in the macroeconomic aggregates: Gross Domestic Product, Gross National Income and Disposable Income.

Keywords: Social Accounting Matrix; Socio-Demographic Matrices; Informal Economy.

JEL Classification: E01; E16; J11

(December 2015)

Notes:

- The author gratefully acknowledges the financial support provided by FCT (*Fundação para a Ciência e a Tecnologia*) Portugal for the research and writing of this article, which forms part of the Strategic Project for 2014 (PEst-OE/EGE/UI0436/2014).
- This paper is a revised version of the paper entitled “Studying the informal aspects of the activity of countries with Social Accounting and Socio-Demographic Matrices”, presented at the *22nd International Input-Output Conference* - Lisboa (Portugal): 14-18/7/2014, which can also be found in the Working Paper No. 17 /2014/DE (Department of Economics)/UECE (Research Unit on Complexity and Economics) – ISEG (School of Economics and Management) / University of Lisboa, September 2014.
- This paper was presented to the *23rd International Input-Output Conference*, held in Mexico City – Mexico on 22-26/6/2015.

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CONTENTS

1. Introduction	1
2. Approaches based on SAMs and SDMs	1
3. A SAM-based approach	
3.1. Constructing and working with numerical versions of SAMs	3
3.1.1. The SAM's basic structure and its consistency with the whole system	5
3.1.2. Disaggregations and extensions	10
3.1.3. Aggregates, indicators and balancing items	16
3.2. An algebraic version of the SAM: the accounting multipliers	20
4. Constructing numerical versions of SDMs	22
5. Studying the informal aspects of the activity of countries with SAMs and SDMs	26
6. Summary and concluding remarks	37
References	38

List of Tables

1. The Basic SAM by blocks	6
2. Basic SAM of Portugal in 2009	9
3. SAM of Portugal in 2009, with disaggregated factors of production and the (domestic) institutions' current and capital accounts	15
4. Portuguese functional distribution of the income generated in 2009	18
5. Portuguese institutional distribution of the income generated in 2009	19
6. Portuguese distribution and use of disposable income among institutions in 2009	19
7. The SAM in endogenous and exogenous accounts	20
8. The standard SDM	22
9. SDM of Portugal in 2009 with population by age group	24
10. SDM of Portugal in 2009 with population by age group and economic activity	25
11. SDM of Portugal in 2009 with population by age group, economic activity and market participation	29
12. SAM of Portugal in 2009, with disaggregated factors of production, the (domestic) institutions' current and capital account, and formal and informal labour and households	32
13. Percentage changes in macroeconomic aggregates in the three scenarios of possible increases in informal aspects of the activity of Portugal in 2009	36

1. Introduction

The Social Accounting Matrix (SAM) and the Socio-Demographic Matrix (SDM) are tools that have specific features intended for studying the activity of countries. Both matrices cover movements in time and space, which are expressed by the former matrix in units of currency and by the latter matrix in terms of human beings.

Such features allow for the reading and interpretation of the reality under study, leading to the production of an empirical work which is not only capable of highlighting specific aspects of that activity, but also offers the chance to experiment with different interventions with regard to its functioning.

Section 2 outlines the main features of the SAM and SDM-based approaches, adopting a methodological framework which is based on Richard Stone's works. According to this methodological framework, SAMs and SDMs can describe the activity of countries either empirically or theoretically, depending on whether they are presented in a numerical or an algebraic version, respectively.

A proposal is made for the development both of a basic SAM and of a standard SDM in Sections 3 and 4. Together with an explanation of possible alternative taxonomies, this presentations show how these matrices can be used as an alternative support for studies being carried out in several areas, as well as for the work of those taking part in the policy decision process. Numerical and algebraic versions of SAMs are presented in a SAM-based approach, proposed in Section 3. Numerical versions of SDMs are, in turn, presented in Section 4.

Using the example of an application for Portugal, Section 5 shows how those approaches can be used as an alternative support for studying the informal aspects of the activity of countries at a macroeconomic level.

A summary and some concluding remarks will be made in Section 6.

2. Approaches based on SAMs and SDMs

Richard Stone worked largely with SAMs and SDMs as matrix formats of the national and demographic accounts, either in numerical and algebraic versions. In keeping with that work, and due to their similarities, we will call the approach based on SAMs the SAM-based approach – the term that is normally adopted – and the approach based on SDMs the SDM-based approach – a term that is not normally adopted, but which will be used here.

Following the work of Richard Stone, both Graham Pyatt and Jeffrey Round in particular played a key role in the study and dissemination of the SAM-based approach.

In the foreword to the book which can now be regarded as a pioneering work in terms of the SAM-based approach, “Social Accounting for Development Planning with special reference to Sri Lanka”, Stone stated that the framework of the system of national accounts can be rearranged and “the entries in a set of accounts can be presented in a matrix in which, by convention (...), incomings are shown in the rows and outgoings are shown in the columns; and in which, reflecting the fact that accounts balance, each row sum is equal to the corresponding column sum”. That matrix, with an equal number of rows and columns, is the SAM, in the construction of which “it may be possible to adopt a hierarchical approach, first adjusting the entries in a summary set of national accounts and then adjusting subsets of estimates to these controlling totals”. (Pyatt and Roe, 1977: xix, xxiii).

In turn, in the abstract to his article “A SAM approach to modeling”, Pyatt says: “Given that there is an accounting system corresponding to every economic model, it is useful to make the accounts explicit in the form of a SAM. Such a matrix can be used as the framework for a consistent dataset and for the representation of theory in what is called its transaction form”. In that transaction form (or TV (transaction value) form), the SAM can be seen “(...) as a framework for theory” and its cells “(...) can be filled instead with algebraic expressions, which describe in conceptual terms how the corresponding transaction values might be determined”. Thus, the SAM is used as “the basic framework for model presentation”. (Pyatt, 1988: 327; 337).

Looking at the question from the perspectives outlined above, it can be said that a SAM can have two versions: a numerical version, which describes the activity of a country empirically; and an algebraic version, which describes that same activity theoretically. In the former version, each cell has a specific numerical value, with the sums of the rows being equal to the sums of the columns. In the latter version, each cell is filled with algebraic expressions that, together with those of all the other cells, form a SAM-based model, the calibration of which involves a replication of the numerical version.

In the words of Pyatt, “the essence of (...) the SAM approach to modelling is to use the same SAM framework for both the empirical and the theoretical description of an economy”. (Pyatt, 1988: 337).

The construction of algebraic versions (or SAM-based models) can be seen, among others, in Pyatt (2001; 1988), Pyatt and Roe (1977), Pyatt and Round (2012; 1985) and Santos (2012; 2009). A specific SAM-based approach will be examined in section 3.

Despite the potentialities of Stone’s work on SDMs, the SDM-based approach has not been followed by other authors as much as the SAM-based approach has. Thus, the study of the SDM-based approach will be based only on Stone’s work.

According to Stone, the population of a specific country in a specific year “flows in partly along time from last year, through survival, and partly along space from the outside world, through birth and

immigration; and flows out, through death and emigration, and partly along time into next year, through survival” (Stone, 1986: 21). With the survivors from the preceding period constituting the opening stock of the population and the survivors into the succeeding period constituting the closing stock, the SDM can thus be considered a stock-flow matrix.

By connecting “the opening and closing stocks of year θ with flows during year θ ” (Stone, 1982: 292), two types of versions will be identified for the SDM: numerical versions, in which each cell has a specific numerical value; and algebraic versions, in which each cell is filled with algebraic expressions that, together with those of all the other cells, form a SDM-based model.

Numerical versions of SDMs can thus be constructed from demographic statistics or they can be replicated by the running of SDM-based models. The former versions measure the reality under study and will be examined in section 4. The latter versions allow for the construction of scenarios resulting from experiments performed with those models, and can be seen in: Stone, 1966, 1971, 1973, 1975, 1981, 1982, 1985, 1986a.

Assuming that the core of the statistics representing the part of the activity of countries that can be expressed in currency units (covered by the SAM), and in human beings (covered by the SDM), are the national and the demographic accounts, respectively, at least as a starting point, their adoption is recommended for any study that is looking for empirical evidence about that activity. This will enable one to work with, and gain a greater knowledge about the activity that is (supposedly) observed by the national and the demographic accounts, which, both in a SAM and a SDM framework, will benefit from the increased analytical content provided by the matrix format and the possibility of capturing and working with networks of linkages not captured or worked on otherwise.

3. A SAM-based approach

3.1. Constructing and working with numerical versions of SAMs

The latest versions of the SNA have devoted a number of paragraphs to discussing the question of SAMs. The 2008 version mentions SAMs in Section D of its Chapter 28, entitled “Input-output and other matrix-based analysis” (ISWGNA, 2009: 519-522), in which a matrix representation is presented of the accounts identified and described in the whole SNA. This representation is not, however, to be identified with the SAM presented in this paper, although they both cover practically all the flows recorded by those accounts.

In turn, the European System of National and Regional Accounts in the European Union of 2010¹ (the adaptation for Europe of the 2008 version of the SNA) makes a reference to the SAM, stating that, among other features, it can be thought of as an expanded system of labour (satellite) accounts (Chapter 22).

The SAM that will be presented below results from the work that the author has undertaken within the methodological framework presented in Section 2, based especially on the works of Graham Pyatt and his associates (Pyatt, 1988 and 1991; Pyatt and Roe, 1977; Pyatt and Round, 1985 and 2012), as well as from the efforts made to reconcile that framework with what has been defined by (the successive versions of) the SNA (Pyatt, 1985 and 1991a; Round, 2003; Santos, 2009). Thus, the author will propose a version of a SAM that seeks to be as exhaustive as possible regarding the flows observed by the SNA. Pyatt (1999) and Round (2003) also approach this same issue with the use of their own versions.

The following proposal will be accompanied by the applications made of that SAM to Portugal in 2009. In that year, the Portuguese national accounts adopted the European System of National and Regional Accounts in the European Community of 1995 – the adaptation for Europe of the 1993 version of the SNA. Because the general differences between the accounts identified in those applications and described in the 1993 and 2008 versions of the SNA are not significant, they will be used to illustrate the following exposition.

Thus, returning to the description provided in Section 2, a square matrix will be worked upon, in which the sum of the rows is equal to the corresponding sum of the columns. In keeping with what is conventionally accepted, and after some adjustments have been made to adapt this to the SNA, resources, incomes, receipts or changes in liabilities and net worth will be represented in the entries made in the rows, while uses, outlays, expenditures or changes in assets will be represented in the entries made in the columns. Each flow will therefore be recorded only once, in a cell of its own. The following description will be made in accordance with the 2008 SNA.

The starting point for the construction of a numerical SAM should be its design, i.e. the classification or taxonomy of its accounts. That taxonomy and the levels of disaggregation adopted will depend on the purposes for which the SAM is to be used, as well as on the way that the available information is organised. Adopting the national accounts as the base source of information, a basic structure is proposed below, which takes into account the underlying SNA and highlights the consistency of the whole system. The flexibility of that basic structure will be shown, together with the possibilities that

¹ EU Regulation No. 549/2013 of the European Parliament and of the European Council of 21 May 2013, on the European system of national and regional accounts in the European Union – Official Journal of the European Union, L174, Volume 56, 26 June 2013.

it presents for characterising problems and for achieving specific purposes. These will also be seen as possibilities for going beyond the SNA, which is considered as a starting point, as mentioned in Section 2.

In this respect, we are aware of the dangers associated with the adoption of international standards and systems of classification and their failure to recognise important issues and realities. This problem is also mentioned by Pyatt and Round when they consider the choice of taxonomies within a SAM framework and the strategic influence that these can have on the potential usefulness of subsequent applications. According to those authors: “the taxonomies that are embedded within [the SAM framework] predetermine what any subsequent modelling exercise might have to say in response to specific distributional questions” (Pyatt and Round, 2012: 270).

3.1.1. The SAM’s basic structure and its consistency with the whole system

Adopting the working method recommended by Stone in the third paragraph of Section 2 of this paper, the basic structure for the SAM presented below will be a summary set of the national accounts and the controlling totals for the other levels of disaggregation, which will later be analysed in Subsection 3.1.2. Thus, in keeping with the conventions and nomenclatures defined by the SNA, besides a rest of the world account, the proposed SAM will also include both production and institutional accounts.

Table 1 shows the above-mentioned basic structure, representing the nominal transactions (“t”) with which two indexes are associated. The location of these transactions within the matrix framework is described by those indexes, the first of which represents the row account while the second represents the column account. Each cell of this matrix will be converted into a submatrix, with the number of rows and columns corresponding to the level of disaggregation of the row and column accounts. This same table also identifies blocks, which are submatrices or sets of submatrices with common characteristics. The specification of these blocks will be made below and involves an identification of the flows of the National Accounts, which will continue to be the same even if some disaggregation is performed – thereby preserving the consistency of the whole system.

Table 1. The Basic SAM by blocks

	p	a	f	dic	dik	dif	rw	total
p – products	TTM ($t_{p,p}$)	IC ($t_{p,a}$)	0	FC ($t_{p,dic}$)	GCF ($t_{p,dik}$)	0	EX ($t_{p,rw}$)	AD ($t_{p,\cdot}$)
a – activities	P ($t_{a,p}$)	0	0	0	0	0	0	VPT ($t_{a,\cdot}$)
f – factors	0	CFP_GAV ($t_{f,a}$)	0	0	0	0	CFP ($t_{f,rw}$)	AFIR ($t_{f,\cdot}$)
dic – (domestic) institutions' current account	NTP ($t_{dic,p}$)	NTA ($t_{dic,a}$)	CFP_GNI ($t_{dic,f}$)	CT ($t_{dic,dic}$)	0	0	CT ($t_{dic,rw}$)	AI ($t_{dic,\cdot}$)
dik – (domestic) institutions' capital account	0	0	0	S ($t_{dik,dic}$)	KT ($t_{dik,dik}$)	NLB ($t_{dik,dif}$)	KT ($t_{dik,rw}$)	INVF ($t_{dik,\cdot}$)
dif – (domestic) institutions' financial account	0	0	0	0	0	FT ($t_{dif,dif}$)	FT ($t_{dif,rw}$)	TFTR ($t_{dif,\cdot}$)
rw – rest of the world	IM&NTP ($t_{rw,p}$)	NTA ($t_{rw,a}$)	CFP ($t_{rw,f}$)	CT ($t_{rw,dic}$)	KT ($t_{rw,dik}$)	FT ($t_{rw,dif}$)	0	TVRWP ($t_{rw,\cdot}$)
total	AS ($t_{\cdot,p}$)	VCT ($t_{\cdot,a}$)	AFIP ($t_{\cdot,f}$)	AIP ($t_{\cdot,dic}$)	AINV ($t_{\cdot,dik}$)	TFTP ($t_{\cdot,dif}$)	TVRWR ($t_{\cdot,rw}$)	

Source: Own construction

Note: The first three accounts (p = products (or goods and services), a = activities (or industries) and f = factors (of production)) are the production accounts of the economy and the next three accounts (dic = current; dik = capital; dif = financial) are the accounts of the (domestic) institutions. The last account (rw = rest of the world) represents the “outside” part of the (domestic) economy.

Description of the blocks (included in the texts are letters followed by numbers between brackets, which are the flow codes of the National Accounts, in accordance with the 2008 SNA):

- a) Production – P (cell: $t_{a,p}$; basic prices) – represents the output of goods and services (P1).
- b) Domestic Trade is represented by the value of domestically transacted products, which can be either domestically produced or imported.
 - b.1) Intermediate Consumption – IC (cell: $t_{p,a}$; purchasers' prices) – consists of the value of the goods and services consumed as inputs by a process of production, excluding those fixed assets whose consumption is recorded as consumption of fixed capital (P2).
 - b.2) Final Consumption – FC (cell: $t_{p,dic}$; purchasers' prices) – consists of the expenditure incurred by resident institutional units on goods or services that are used for the direct satisfaction of individual needs or wants, or the collective needs of members of the community (P3).
 - b.3) Gross Capital Formation – GCF (cell: $t_{p,dik}$; purchasers' prices) – includes gross fixed capital formation, changes in inventories, and acquisitions less disposals of valuables (P5).

- c) External Trade includes the transactions in goods and services from non-residents to residents, also known as imports (P7), or IM (cell: $t_{rw,p}$; purchasers' prices), and the transactions in goods and services from residents to non-residents, also known as exports (P6), or EX (cell: $t_{p,rw}$; purchasers' prices).
- d) Trade and Transport Margins – TTM (cell: $t_{p,p}$) – amounts to zero and, when it is disaggregated and takes the form of a submatrix, it allocates the output of the trade and transport services used in the domestic trade to the supplied products.
- e) Net taxes on production and imports
 - e.1) Net Taxes on Production – NTA (cells: $t_{dic,a}$; $t_{rw,a}$) – represents the (other) taxes on production (D29) minus the (other) subsidies to production (D39).
 - e.2) Net Taxes on Products – NTP (cells: $t_{dic,p}$; $t_{rw,p}$) – represents the taxes on products (D21) minus the subsidies on products (D31).
- f) Compensation of Factors of Production – CFP (cells: $t_{f,a}$; $t_{dic,f}$; $t_{f,rw}$; $t_{rw,f}$) – consists of the income of the institutional sectors originating from the compensation of employees (D1) and the compensation of employers and own-account (or self-employed) workers, and the compensation of capital, including property income (D4; B2g-B3g). The functional distribution is represented by the Gross Added Value – GAV (cell: $t_{f,a}$), whereas the institutional distribution is represented by the Gross National Income – GNI (cell: $t_{dic,f}$).
- g) Current Transactions – CT (cells: $t_{dic,dic}$; $t_{dic,rw}$; $t_{rw,dic}$) – includes: current taxes on income, wealth, etc. (D5); net social contributions (D61); social benefits other than social transfers in kind (D62); other current transfers (D7); and the adjustment made for the change in pension entitlements (D8).
- h) Capital Transactions – KT (cells: $t_{dik,dik}$; $t_{dik,rw}$; $t_{rw,dik}$) – includes: capital taxes (D91); investment grants (D92); other capital transfers (D99).
- i) Financial Transactions – FT (cells: $t_{dif,dif}$; $t_{dif,rw}$; $t_{rw,dif}$) – includes: monetary gold and special drawing rights (F1); currency and deposits (F2); debt securities (F3); loans (F4); equity and investment fund shares (F5); insurance, pension and standardised guarantee schemes (F6); financial derivatives and employee stock options (F7); and other accounts receivable/payable (F8).
- j) Gross Saving – S (cell: $t_{dik,dic}$) – measures the portion of aggregate income that is not used for final consumption expenditure and current transfers to domestic institutions or to the rest of the world (B9g).
- k) Net Borrowing/Lending – NLB (cell: $t_{dik,dif}$)

The net lending or borrowing of the total economy is the sum of the net lending or borrowing of the institutional sectors. It represents, respectively, the net resources that the total economy makes

available to the rest of the world or the net resources that it receives from the rest of the world to finance the corresponding needs of investment funds (B9).

Here, those amounts are recorded in the row(s) of the capital account, i.e. as changes in liabilities and net worth, and in the column(s) of the financial account, i.e. as changes in assets. This is why the mathematical signs of this item have been changed in relation to the SNA.

The construction of a SAM is easier when it is performed by blocks.

The totals of each account represent the corresponding sums of the cells in rows and in columns, with the following description:

- I. Products account (p): Aggregate Demand – AD, the row sum (cell: t_p); Aggregate Supply – AS, the column sum (cell: t_p).
- II. Activities account (a): Production Value – VPT, the row sum (cell: t_a); Total Costs – VCT, the column sum (cell: t_a).
- III. Factors of Production (f): Aggregate Factors Income (Received) – AFIR, the row sum (cell: t_f); Aggregate Factors Income (Paid) – AFIP, the column sum (cell: t_f).
- IV. Current account of (domestic) institutions (dic): Aggregate Income (received) – AI, the row sum (cell: t_{dic}); Aggregate Income (Paid) – AIP, the column sum (cell: t_{dic}).
- V. Capital account of (domestic) institutions (dik): Investment Funds – INV, the row sum (cell: t_{dik}); Aggregate Investment – AINV, the column sum (cell: t_{dik}).
- VI. Financial account of (domestic) institutions (dif): Total Financial Transactions (Received) – TFTR, the row sum (cell: t_{dif}); Total Financial Transactions (Paid) – TFTP, the column sum (cell: t_{dif}).
- VII. Rest of the world account (rw): Value of Transactions to the Rest of the World (Paid) – TVRWP, the row sum (cell: t_{rw}); Value of Transactions from the Rest of the World (Received) – TVRWR, the column sum (cell: t_{rw}).

From the above description, two further advantages of the matrix presentation of the national accounts can be highlighted: each transaction represents a single entry and can be characterised by its position; each account is represented by a row and a column, whose balance is ensured by the equality of their sums.

The Integrated Economic Accounts Table is equivalent to a summary of what is observed by the SNA. According to the 2008 SNA: “The integrated economic accounts use (...) three of the conceptual elements of the SNA (...) [institutional units and sectors, transactions, and assets and liabilities] together with the concept of the rest of the world to form a wide range of accounts. These include the full sequence of accounts for institutional sectors, separately or collectively, the rest of the world and the total economy.... This table shows, simultaneously, the general accounting structure of the SNA

and presents a set of data for the institutional sectors, the economy as a whole and the rest of the world” (ISWGNA, 2009: 23; 29). Based on this table and the previous description (adapted to the previous version of the SNA), it was possible to construct the basic SAM presented in Table 2, representing the highest possible level of aggregation of the activity of Portugal observed by the national accounts in 2009.

Considering the description given about Table 1, and based on the reading of the products account in Portugal in 2009, represented in Table 2 – row and column p, the main components of the aggregate demand and supply of the goods and services transacted in the market and captured by the Portuguese National Accounts, can be identified in millions of euros. Thus, reading in rows, the total aggregate demand of 390,882 million euros was composed of 162,661million euros of intermediate consumption, 146,934 million euros of final consumption, and 34,051 million euros of gross capital formation and 47,236 million euros of exports. Reading in columns, the total aggregate supply of 390,882 million euros (equal to the total aggregate demand) was composed of 311,365 million euros from the output of goods and services, 19 694 million euros of net taxes on products received by the Portuguese Government and 59,717 million euros of imports and 106 million euros of net taxes on products sent to the institutions of the European Union. A similar reading can be made for each of the other columns and rows of Table 2 for Portugal.

Table 2. Basic SAM of Portugal in 2009

(Unit: 10⁶ euros)

	p	a	f	dic	dik	dif	rw	total
p – products	0	162 661		146 934	34 051		47 236	390 882
a – activities	311 365							311 365
f – factors		149 403					9 039	158 443
dic – (domestic) institutions’ current account	19 694	522	141 423	85 711			4 581	251 931
dik – (domestic) institutions’ capital account				15 865	1 536	16 222	2 232	35 856
dif – (domestic) institutions’ financial account						36 659	37 209	73 868
rw – rest of the world	59 823 ^(a)	- 1 222	17 019	3 421	268	20 987		100 297
total	390 882	311 365	158 443	251 931	35 856	73 868	100 297	

Sources: Statistics Portugal (*INE*); Portuguese Central Bank (*Banco de Portugal*).

^(a) 59 717 (imports) + 106 (net taxes on products sent to the institutions of the European Union)

Therefore, as mentioned above, and again using the words of Stone, the basic SAM that has just been described can be considered as the most aggregate “summary set of national accounts”, representing a first level of the intended hierarchical method, with all the controlling totals for the next level of that hierarchy. From here the consistency of the whole (supposedly) observed system can be ensured.

3.1.2. Disaggregations and extensions

Since the national accounts cover all the details covered by the basic structure presented above, some other levels of the above mentioned-hierarchical method can be identified within the national accounts, providing other controlling totals for greater levels of disaggregation. As will be seen below, this disaggregation can be made at the levels of the production, institutional and rest of the world accounts, either within the scope of the SNA conventions or not. Reverse reasoning can be applied to the case of aggregation. Therefore, in addition to the already-mentioned advantages of presenting the national accounts in the form of a matrix, it is also possible to make an easier aggregation and disaggregation of the accounts, in accordance with the specific requirements of the exercise and the available information, without losing the consistency of the system.

In the words of Round, in his Foreword to Santos (2009): “The key to constructing a useful SAM and developing an effective SAM-based model is the SAM design. A SAM need not be dimensionally large as long as it represents the most significant features of economy-wide interdependence. More precisely, this means designing the SAM so that the key sectors, markets and institutions are as fully represented as is practicable. Estimation of the transactions between accounts is obviously also important but this needs to go in tandem with the SAM design” (Santos, 2009: xiv).

It is also worth mentioning that, although the quarterly national accounts are not as complete as the annual ones, it will nonetheless be possible to make some further disaggregations from these accounts in terms of time.

Furthermore, disaggregations can be made in terms of space, since regional accounts are also considered. In that case, it is possible to work with regions and countries, either individually or as a group. Round (1991; 1994), for example, experimented with the case of Europe. It would even be possible to think in world terms, if the SNA could be adopted worldwide.

Extensions are also possible, either from the national accounts or from other sources of information, with the convenient adjustment to, or connection with, the whole system in order to maintain its consistency.

The 2008 SNA dedicates its Chapter 29 to “Satellite accounts and other extensions” (ISWGNA, 2009: 523-544)², where the main idea is to serve specific analytical purposes, in a way that is consistent with the central framework, although not fully integrated into it (ISWGNA, 2009: 37-38). In this respect, the author would like to support Steven Keuning and Willem Ruijter’s idea of a “complete data set” which “could be tentatively labelled: a System of Socio-economic Accounts” (Keuning and Ruijter, 1988: 73).

a) Production accounts

In the basic structure proposed above, the production accounts are the accounts of products, activities and factors of production. These accounts correspond respectively to the SNA accounts of goods and services, production and the primary distribution of income. Thus, within these accounts and depending on the available level of disaggregation, it can be seen how the available products are used, with some details being provided about the process of production and about the way in which the incomes resulting from that process and the ownership of assets are distributed among institutions and activities.

The SNA uses the Central Product Classification (CPC) Version 2 (completed in December 2008) to classify products (ISWGNA, 2009: 19), which are organised into 10 sections, with it being possible to go as far as the fifth level of disaggregation within each of these.

In turn, the International Standard Industrial Classification of All Economic Activities (ISIC) Revision 4 (officially released in August 2008) is used to classify activities (ISWGNA, 2009: 20), organised into 23 sections, the disaggregation of which is perfectly consonant with that of the product classification. The Supply and Use Table provides this information, usually at an intermediate level of disaggregation.

As described above, in the characterisation of the block representing the compensation of the factors of production, the disaggregation that can be made from the already mentioned tables of the national accounts is between labour (or the compensation of employees) and what has been referred to as the compensation of other factors, which includes the compensation of employers and own-account (or self-employed) workers, and the compensation of capital, namely property income. Such information can only be derived from the Integrated Economic Accounts Table if the products and activities accounts are not disaggregated, or from the Supply and Use Table if those same accounts are disaggregated. Table 3, which contains the above-mentioned application to Portugal, in which the

² The 2010 ESA dedicates its Chapter 22 to that same subject (see footnote 1).

products and activities accounts are not disaggregated, presents the possible disaggregation of the factors of production accounts based on the Integrated Economic Accounts Table.

Regarding the design of SAMs and in order to establish a connection between the taxonomies dealt with in this Subsection (a) and in the next (b), it should be mentioned that in their latest work, besides a rest of the world account, Pyatt and Round identify accounts for goods and non-factor services and factor services, as well as, accounts for institutions. In the latter, they identify private and public sector current accounts and combined capital accounts. About this classification, they say the following: “taxonomies for goods and services serve to distinguish different markets and should therefore be constructed in ways that recognise significant market failures and segmentation. In contrast, the institutions within the private sector are differentiated by the assets they own (or do not own...) and the productive activities they are responsible for.... Factors of production and the assets that provide them are therefore the defining feature of institutions.” (Pyatt and Round, 2012: 268).

b) Institutions and rest of the world accounts

In the basic structure proposed in Subsection 3.1.1, the domestic institutions are divided into current, capital and financial accounts. These accounts correspond, respectively, to the following SNA accounts: secondary distribution of income, redistribution of income in kind and use of income; capital; and financial accounts. Within these accounts, depending on the level of disaggregation available, the current accounts show how the national income is transformed into disposable income through the receipt and payment of current transfers, and how the latter is distributed between final consumption and saving. In turn, the capital account records the transactions linked to acquisitions of non-financial assets and capital transfers involving the redistribution of wealth, whereas the financial account records the transactions in financial assets and liabilities between institutional units, and between these and the rest of the world.

All the linkages between the domestic economy and the rest of the world, i.e. all the transactions between resident and non-resident units, are recorded both in the SAM and in the SNA through the rest of the world account.

Chapter 4 of the 2008 SNA specifies the institutional sectors, including the rest of the world, and their possible disaggregation, which in some cases can be taken as far as the third level (ISWGNA, 2009: 61-85), although normally it cannot be taken beyond the first level. In the case of the rest of the world, such disaggregation will certainly depend on the country, or group of countries, that adopt and adapt this system³.

³ In the case of the 2010 ESA (Chapter 23), a second level of disaggregation is made, with a distinction being drawn between Member States and institutions and bodies of the European Union and non-member countries and international

At the first level of disaggregation, the accounts of the institutions, as well as the rest of the world account, are part of the Integrated Economic Accounts Table. Higher levels of disaggregation, whenever these are possible, are usually published in the separate accounts of institutions. Even at the first level of disaggregation, any work conducted with the institutional sectors when there are transactions involving more than one row or column of the SAM also requires the so-called “from whom to whom matrices”. These matrices make it possible to fill in the cells of the submatrices of transactions taking place within domestic institutions and between institutions and the rest of the world, recorded in the above-described blocks of current, capital, and financial transactions (Subsection 3.1.1. g-i).

As will be exemplified in Section 5, the disaggregation of specific institutional sectors makes it possible to analyse the most diverse aspects of the corresponding roles in the activity of countries (Santos (2004) and (2007) are examples of studies on the role of the general government and its subsectors – central government, local government and social security funds).

The detailed study of the specific accounts of domestic institutions and their corresponding transactions also makes it possible to analyse specific aspects of that same activity: the distribution and redistribution of income, using the current account; the redistribution of wealth, using the capital account; investment, its financing, and the implicit levels of the financing requirements and availability of the institutional sectors and the whole economy, using the capital and financial accounts.

In turn, the rest of the world account can provide many possibilities for studying the international economic relations of the domestic economy.

Table 3 presents the possible disaggregation of the institutions’ current and capital accounts, made from the Integrated Economic Accounts Table and the “from whom to whom matrices”, for the above-mentioned application. From that table, we can discover a little more about the reality under study – Portugal in 2009. This is the case with the aggregate factors income – the so-called primary distribution of income, to the amount of 158,443 million euros, in which it can now be seen that 86,127 million euros account for the compensation of employees – row and column 3, and 72,315 million euros account for the compensation of other factors of production, namely employers and own-account workers, land and capital (including property income) – row and column 4.

Through row 3 we can see that 85,888 million euros represent the part of the gross added value, generated in the domestic economy by residents and non-residents that is attributed to the

organisations that are not resident in the European Union. For the former, the disaggregation can be made as far as the fourth level (see footnote 1).

compensation of employees, to which are added 239 million euros generated abroad by residents. In turn, row 4 shows that 63,515 million euros represent the part of the gross added value, generated in the domestic economy by residents and non-residents, that is attributed to the above-mentioned other factors of production, to which are added 8,800 million euros generated abroad by residents. Rows 3 and 4 allow for the study of aspects related with the functional distribution of income.

Through column 3, we can see that 85,757 million euros represent the part of the gross national income, generated in the domestic economy and abroad by residents, that is attributed to the compensation of employees, to which are added 370 million euros generated in the domestic economy by non-residents and sent abroad. In column 4, we can see that 55,666 million euros is the part of the gross national income, generated in the domestic economy and abroad by residents, that is attributed to the compensation of other factors, to which are added 16,649 million euros generated in the domestic economy by non-residents and sent abroad. From the cells of columns 3 and 4, it is possible to study aspects related to the institutional distribution of income.

Table 3. SAM of Portugal in 2009, with disaggregated factors of production and the (domestic) institutions' current and capital accounts

(Unit: 10⁶ euros)

Outlays (expenditures) <		
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Sources: Statistics Portugal (*INE*); Portuguese Central Bank (*Banco de Portugal*).

Table 3 (continued). SAM of Portugal in 2009, with disaggregated factors of production and the (domestic) institutions' current and capital accounts
(Unit: 10⁶ euros)

Outlays (expenditures) <			
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Sources: Statistics Portugal (*INE*); Portuguese Central Bank (*Banco de Portugal*).

Just as the matrix form of the production accounts may be easily worked on from the supply and use tables, it would also be possible to work on the matrix form of the institutional accounts if some kind of “from whom to whom tables” were made official. This would be a crucial factor for implementing the SAM-based approach, in which SAMs with production and institutional accounts, conveniently capturing the circular flow of income and the underlying network of linkages, would form the basis for macroeconomic models capable of reproducing the multiplier processes implicit in the activity of countries.

3.1.3. Aggregates, indicators and balancing items

As was seen above, practically all the transactions of the national accounts are covered by the SAM, so that macroeconomic aggregates, indicators and balancing items can be identified from it (see the description of the cells or blocks in Table 1, as well as Tables 2 and 3 for the application to Portugal). Gross Domestic Product at market prices (GDP_{pm}), which is usually considered the main macroeconomic aggregate, can be calculated in the three known approaches:

- Production approach: $GDP_{pm} = P - IC + NTP = t_{a,p} - t_{p,a} + (t_{dic,p} + \text{(part of)} t_{rw,p})$;
- Expenditure approach: $GDP_{pm} = FC + GCF + Ex - IM = t_{p,dic} + t_{p,dik} + t_{p,rw} - \text{(part of)} t_{rw,p}$;
- Income approach: $GDP_{pm} = GAV + NTP + NTA = t_{f,a} + (t_{dic,p} + \text{(part of)} t_{rw,p}) + (t_{dic,a} + t_{rw,a})$.

The Portuguese GDP_{pm} in 2009 was $168\,504 * 10^6$ euros, which can be calculated from these three approaches as follows:

- Production approach: $GDP_{pm} = 311\,365 - 162\,661 + (19\,694 + 106)$;
- Expenditure approach: $GDP_{pm} = 146\,934 + 34\,051 + 47\,236 - 59\,717$;
- Income approach: $GDP_{pm} = 149\,403 + (19\,694 + 106) + (522 - 1\,222)$.

Domestic Product can be converted into National Product by adding the compensation of factors received from the rest of the world and deducting the compensation of factors and the net indirect taxes (on both products and production) sent to the rest of the world, when these exist. Thus, from the described cells of the basic SAM, GDP_{pm} can be converted into Gross National Product at market prices (GNP_{pm}) or Gross National Income (GNI_{pm}), as follows: $GDP_{pm} + t_{f,rw} - t_{rw,f} - t_{rw,a} - \text{(part of)} t_{rw,p}$. On the other hand, as the SAM directly provides Gross National Income, this can also be calculated just by adding the net indirect taxes (on both products and production) received by domestic institutions: $t_{dic,f} + t_{dic,p} + t_{dic,a}$. The corresponding amount for Portugal in 2009 is $161\,639 * 10^6$ euros, for which the underlying calculations are as follows: $GNP_{pm} = 168\,504 + 9\,039 - 17\,019 - (-1\,222) - 106$; $GNI_{pm} = 141\,423 + 19\,694 + 522$.

Disposable Income (Domestic or National) is also very important and can be calculated by adding to GNI_{pm} the net current transactions received by domestic institutions: $GNI_{pm} + ((received)_{t_{dic,dic} + t_{dic,rw}}) - ((paid)_{t_{dic,dic} + t_{rw,dic}})$. In our application to Portugal: $161\,639 + (85\,711 + 4\,581) - (85\,711 + 3\,421) = 162\,800 * 10^6$ euros.

In turn, gross aggregates can be converted into net aggregates (and balancing items) by deducting the consumption of fixed capital, which lies outside the basic SAM but is part of the integrated economic accounts.

Gross Saving (S) and Net Lending or Borrowing (NLB) are given directly by the SAM, through $t_{dik,dic}$ and $t_{dik,dif}$, respectively, which in the case of Portugal in 2009 are: 15 865 and $16\,222 * 10^6$ euros. As explained in Subsection 3.1.1 - k), the latter amount represents Net Borrowing.

It is also possible to calculate structural indicators of the functional and institutional distribution of generated income, as well as indicators of the use of disposable income.

In the functional distribution of generated income, the distribution of gross added value – GAV – among the factors of production is given by the structure of the submatrix in cell $t_{f,a}$ of the basic structure, with its level of detail depending on the disaggregation of the activities (column account) and of the factors of production (row account). Table 4 shows the results for the applications to Portugal.

Table 4. Portuguese functional distribution of the income generated in 2009 (in percentage terms)

	%
Factors of Production (generated income = gross added value or gross domestic product)	
Labour (employees)	57.5
Other (employers and own-account workers; capital)	42.5
Total	100.0

Source: Table 3

In the institutional distribution of generated income, the distribution of gross national income – GNI – is given by the structure of the submatrix in cell $t_{dic,f}$ of the basic structure. In this case, the level of detail will depend on the disaggregation of the factors of production (column account) and of the current account of the domestic institutions (row account). Table 5 shows the results of our application.

Table 5. Portuguese institutional distribution of the income generated in 2009 (in percentage terms)

	Factors of Production		
	Labour (employees)	Other (employers and own-account workers; capital)	Total
Institutions (generated income = gross national income)			
Households	100.0	61.5	84.9
Non-financial corporations		26.3	10.3
Financial corporations		10.8	4.2
General government		- 0.1	0.0
Non-profit institutions serving households		1.5	0.6
Total	100.0	100.0	100.0

Source: Table 3

As described above for the whole economy, the disposable income of the institutional sectors can be calculated in the same way, and then its distribution and use can also be studied – see Table 6.

Table 6. Portuguese distribution and use of disposable income among institutions in 2009 (in percentage terms)

	Distribution of Disposable Income	Use of Disposable Income	
		Final Consumption Expenditure	Saving
Households	73.7	88.6	11.4
Non-financial corporations	5.5	---	100.0
Financial corporations	3.2	---	100.0
General government	15.6	145.9	- 45.9
Non-profit institutions serving households	2.0	111.0	- 11.0
Total	100.0	90.3	9.7

Source: Table 3

The main items in the revenue and expenditure of the institutional sectors and of the rest of the world can be calculated from the respective rows and columns of the SAM. In the case of institutional sectors, the total balancing item is the net lending/borrowing (NLB) of the respective institutional sector, with an opposite mathematical sign to the one registered in the SAM; the current balancing item is the respective gross saving (S); and the capital balancing item is the difference between the first and the second.

3.2. An algebraic version of the SAM: the accounting multipliers

A static and comparative static analysis will be made within a framework in which prices are not separated from quantities, with changes being identified only at the level of values.

It will be assumed that there is excess capacity in the economy and that the production technology and resource endowment are given.

The base methodology that is to be followed is centred upon the use of multipliers. A systematic outline of this methodology is provided below, following Santos (2004 and 2007), in keeping with the work of Pyatt and Roe (1977) and Pyatt and Round (1985).

As shown in Table 7, we will have both exogenous and endogenous accounts, so that consequently the transactions in each cell of the SAM will be considered exogenous or endogenous according to the corresponding row and column accounts.

Table 7. The SAM in endogenous and exogenous accounts

	Endogenous		Exogenous		Total
		Σ		Σ	
Endogenous	N	n	X	x	y_n
Exogenous	L	l	R	r	y_x
Total	y_n'		y_x'		

Source: Pyatt and Round (1985).

Note: As referred above, rows represent resources, incomes, receipts or changes in liabilities and net worth and columns represent uses, outlays, expenditures or changes in assets.

Key:

N = matrix of transactions between endogenous accounts; n = vector of the (corresponding) row sums.

X = matrix of transactions between exogenous and endogenous accounts (injections from first into second); x = vector of the (corresponding) row sums.

L = matrix of transactions between endogenous and exogenous accounts (leakages from first into second); l = vector of the (corresponding) row sums.

R = matrix of transactions between exogenous accounts; r = vector of the (corresponding) row sums.

y_n = vector (column) of the receipts of the endogenous accounts (\hat{y}_n :diagonal; \hat{y}_n^{-1} :inverse); y_n' = vector (row) of the expenditures of the same accounts.

y_x = vector (column) of the receipts of the exogenous accounts; y_x' = vector (row) of the expenditures of the same accounts.

From Table 7, it can be written that

$$y_n = n + x \quad (1)$$

$$y_x = l + r \quad (2)$$

The amount that the endogenous accounts receive is equal to the amount that they spend (row totals equal column totals). In other words, in aggregate terms, total injections from the exogenous into the endogenous accounts (i.e. the column sum of “x”) are equal to total leakages from the endogenous into the exogenous accounts, i.e. considering i' to be the unitary vector (row), the column sum of “1” is:

$$x * i' = l * i'. \quad (3)$$

In the structure of Table 7, if the entries in the N matrix are divided by the corresponding total expenditures, a corresponding matrix (squared) can be defined of the average expenditure propensities of the endogenous accounts within the endogenous accounts or of the use of resources within those accounts. Calling this matrix A_n , it can be written that

$$A_n = N * \hat{y}_n^{-1} \quad (4)$$

$$N = A_n * \hat{y}_n \quad (5)$$

$$\text{Considering equation (1), } y_n = A_n * y_n + x \quad (6)$$

$$\text{Therefore, } y_n = (I - A_n)^{-1} * x = M_a * x. \quad (7)$$

We thus have the equation that gives the total receipts of the endogenous accounts (y_n), by multiplying the injections “x” by the matrix of the accounting multipliers:

$$M_a = (I - A_n)^{-1}. \quad (8)$$

On the other hand, if the entries in the L matrix are divided by the corresponding total expenditures, a corresponding matrix (non squared) can be defined of the average expenditure propensities of the endogenous accounts into the exogenous accounts or of the use of resources from the endogenous accounts into the exogenous accounts. Calling this matrix A_l , it can be written that

$$A_l = L * \hat{y}_n^{-1} \quad (9)$$

$$L = A_l * \hat{y}_n \quad (10)$$

$$\text{Considering equation (2), } y_x = A_l * y_n + r \quad (11)$$

$$\text{Thus, } l = A_l * y_n = A_l * (I - A_n)^{-1} * x = A_l * M_a * x. \quad (12)$$

So, with the accounting multipliers, the impact of changes in receipts is analysed at the moment when they occur, assuming that the structure of expenditure in the economy does not change.

For a study of changes resulting from the increment of the informal aspects of the activity of Portugal in 2009, this methodology allowed the construction of three scenarios, as presented in Section 5.

4. Constructing numerical versions of SDMs

From what was stated in Section 2, just as in any SAM, time and space dimensions can also be identified in any SDM. With an equal number of rows and columns, in each SDM “in any period, the equality of inflows and outflows implies that the difference between the opening and the closing stocks is equal to the net inflow from the outside world” (Stone, 1986: 21). Thus, the SDM connects the opening and the closing stocks of year θ with the flows during the year θ .

In the standard stock-flow SDM, presented in Table 8, the state at New Year θ or $\theta+1$ refers to the position on the 1st of January each year.

Table 8. The standard SDM

(Unit: number of individuals)			
State at New Year θ \ State at New Year $\theta+1$	Outside World	Our Country: Opening States	Closing Stocks
Outside World	α	d'	
Our Country: Closing States	b	S	Λn
Opening Stocks		n'	

Source: Stone (1981, 1982, 1986)

Key:

- α (scalar) = individuals who both enter and leave our country during year θ and so are not recorded in either the opening or the closing stock of that year (babies born in our country during year θ who die in our country or emigrate before the end of it; immigrants into our country during year θ who died in our country or emigrate before the end of it).
- d' (row vector) = individuals who leave our country during year θ and so are recorded in the opening stock but are not included in the closing stock (deaths and emigrants of year θ).
- b (column vector) = individuals who enter our country during year θ and so are recorded in the closing stock but are not included in the opening stock (births and immigrants of year θ).
- S (square matrix) = individuals who survive in our country through year θ and so are recorded in both the opening and the closing stocks (classified by their opening states in the columns and by their closing states in the rows).
- Λn (column vector) = closing stock in each state.
- n' (row vector) = opening stock in each state.

The taxonomic framework, within which each study is developed, will depend not only on its purposes, but also on the information available. The whole population must, however, be included. There is no doubt about the complexity of this work and the difficulty of obtaining credible and adequate statistical data.

As seen above, besides the opening and closing stocks, the SDM also quantifies (for each year) the flows of individuals, which are recorded under “our country: (opening or closing) states”, defined in accordance with the taxonomic framework adopted. As far as those flows are concerned, adopting the words of Stone, “Each year individuals can enter a state in several ways: by survival in that same state from last year, by moving into it from a different state in the course of the year, by birth or by immigration; and they may leave it by survival into the year, by moving into another state during the year, by emigration or by death” (Stone, 1986: 22).

Active or passive sequences can be adopted within this framework. In the case of active sequences, different population groups can be identified, including those who are learning – schoolchildren and students; those who are earning – members of the labour force, who participate in the market; and the rest – all the educationally and economically inactive (in the sense that they do not participate in the labour market and do not produce goods and services transacted in the market). Passive sequences cover socio-economic groups, which may include such considerations as income, social class, family size, etc.

The identification of different age groups can be regarded as the necessary step to be taken before working with an active or a passive sequence.

In the following application to Portugal in 2009, in order to better deal with the above-mentioned complexity and to study the so-called economic activity of the population, two levels of disaggregation were identified. At the first level of disaggregation, the population was organised by age groups. At the second level of disaggregation, within each age group, the population was classified as either active or inactive, in accordance with their economic activity, understood as their participation both in the labour market and in the supply side of the goods and services market. With this process of organisation, the difficulty of obtaining data led, in some cases, to the adoption of estimates and assumptions in order to be able to complete the matrices. The hierarchical method, adopted in the previous section (for the construction of the SAM), was adopted. According to this method, each level of disaggregation has all the controlling totals for the next level of that hierarchy. The specification of the sources and the methodologies adopted in the construction of the following SDMs are available in Santos, 2013.

Table 9. SDM of Portugal in 2009 with population by age group.

(Unit: 10³ individuals)

State at 31/12/2008 State at 31/12/2009		Outside World	Population by age group				Closing Stock
			0-14	15-24	25-64	65 and over	
Outside World			5	5	25	81	10 638
Population by age group	0-14	105	1 510				1 615
	15-24	10	110	1 070			1 190
	25-64	16		146	5 790		5 952
	65 and over	0			108	1 772	1 881
Opening Stock		10 623	1 625	1 221	5 924	1 853	

Source: Statistics Portugal (*INE*).

In the first age group of the population in Portugal in 2009, represented in Table 9 – column and row 0-14, we can see the stocks and the flows of children aged 0 to 14, measured in thousands of individuals. Thus, reading by columns, the opening stock of children was 1,625; of these, 4 died or emigrated, 1,510 remained in that age group throughout the year and 110 moved to the 15-24 age group. Reading by rows, the closing stock was 1,615, which is composed of 105 children surviving births and immigrants and 1,510 children who have not changed state. A similar reading can be made for each of the other columns and rows.

The next level of disaggregation will look at the economic activity (as described above) of the population in Portugal in 2009, within each age group and as represented in Table 10. As was seen above, the economically active population amounts to those people that participate in the labour market and/or produce goods and services transacted in the market. Reading the column of the active 15-24 age group, we can see that the opening stock of the active population aged 15 to 24, measured in thousands of individuals, was 508; of these, 5 died or emigrated, 456 remained in the same situation throughout the year and 47 moved to the active 25-64 age group. Reading the row for the same age group, the closing stock was 466, which is composed of 10 immigrants, and 456 who have not changed state. As was stated for the previous level of disaggregation, a similar reading can be made for each of the other columns and rows.

Table 10. SDM of Portugal in 2009 with population by age group and economic activity.

(Unit: 10³ individuals)

				Outside World	Population by age group and economic activity									Closing Stock	
					0-14	15-24			25-64			65 and over			
						Active	Inactive	Total	Active	Inactive	Total	Active	Inactive	Total	
						1	2		3	4		5	6		7
Outside World		1		5	5		5	22	3	25	42	39	81	10 638	
Population by age group and economic activity	0-14		2	105	1 510									1 615	
	15-24	Active	3	10		456								466	
		Inactive	4		110		614							724	
		Total			10	110			1 070					1 190	
	25-64	Active	5	16		47			4 734					4 797	
		Inactive	6				100			1 056				1 156	
		Total			16				146			5 790			5 952
	65 and over	Active	7	0					35			284			320
		Inactive	8							73			1 488		1 561
		Total			0							108			1 772
Opening Stock		9	10 623	1 625	508	714	1 221	4 791	1 133	5 924	326	1 527	1 853		

Source: Statistics Portugal (*INE*).

The above-described work with population movements within a country, during a specific period captured by a SDM, can complement and improve the information that has been captured by a SAM regarding the production, consumption and income of the institutional sector of households – one of the five institutional sectors identified by the current System of National Accounts (2008 SNA), the others being: financial and non-financial corporations, government and non-profit institutions serving households.

5. Studying the informal aspects of the activity of countries with SAMs and SDMs

Chapter 25 of the 2008 SNA (System of National Accounts) identifies in the activity of countries a part “that reflects the effort of people without formal jobs to engage in some form of monetary economic activity” (ISWGNA, 2009: 471), in which the household unincorporated enterprises, operating within the production boundary of the SNA⁴, sell or barter on the market most or all of their output; in other words, they have market output. Because they operate on a small scale, at a low level of organisation, with little or no division between factors of production, the income that is generated by their activity is the so-called mixed income. Thus, as is mentioned in Chapters 7 and 24 of the 2008 SNA, the mixed income is the compensation of the owner(s) of an unincorporated enterprise or members of the same household that may contribute with unpaid labour inputs of a similar kind to those that could be provided by paid employees. Since the household unincorporated enterprises may operate with or without paid employees, the distinction can be established respectively between employers’ mixed income and own-account workers’ mixed income. Employers and own-account workers are often named self-employed.

Within the framework of the proposed SAM, this compensation of employers and own-account workers can be added to the compensation of employees, thus completing total compensation of labour in the gross added value of the activity of countries, together with the corresponding contribution to the functional distribution of the generated income. In turn, when we think of the institutional distribution of the generated income, the disaggregation of the households may follow what which is defined in Chapter 4-G of the 2008 SNA, in other words in accordance with their main source of income (ISWGNA, 2009: 82-84). The following groups could be studied: employees; employers and own-account workers; recipients of property and transfer income. However, after it is generated, this income follows a path during which it is distributed among institutions and accumulated by institutions, and this factor should not be neglected, otherwise a part of the network of linkages underlying the activity of countries would be missed.

In this respect, we should bear in mind the two general principles recommended by Pyatt and Round regarding the taxonomy to be adopted in the SAMs’ design: “the classifications adopted for factors, for goods and non-factor services, and also for institutions need to be developed jointly” (the activities would certainly be included here, if they had been included in the SAM used in the article⁵); and the “classification system should be designed in such a way that any underlying duality is apparent”

⁴ As defined in Chapter 6 of the 2008 SNA (ISWGNA, 2008: 98-101).

⁵ The inclusion of separate accounts for production activities was not considered important in the context of the article (Pyatt and Round, 2012: 252).

(Pyatt and Round, 2012: 267). Respecting these principles avoids overlooking important parts (which may even be crucial) of the network of linkages, which we have been referring to.

Thus, in the basic structure proposed for a SAM, which is summarised in Table 1, the identification of the informal aspects of the activity of countries involves both production, and institutional accounts, and their corresponding blocks, with special attention being paid to the factors account in the former case and to the (current, capital, and eventually the financial) account of households, in the latter case.

If we assume that the above-mentioned informal part of the activity of countries is observed by the corresponding national accounts, its study will require the disaggregation of those accounts, and so the consistency with the whole system will automatically be guaranteed. Otherwise, those accounts will need to be extended further, and the whole system will need to be adjusted.

Whether in the case of disaggregation or in the case of extension, in the factors accounts, both formal labour (employees) and informal labour (employers and own-account workers) should be identified, with adjustments being made for activities and for products, if these are considered important. In turn, in the institutional accounts, formal and informal households should also be identified. Formal households will be those that, according to their main source of income, are employees or recipients of property and transfer income. The informal households will be those that, according to their main source of income, are employers or own-account workers.

In turn, in the SDM structure that we are proposing, those who participate in the labour market and in the supply side of the goods and services market represent the active population, which can be employed or unemployed. Within the employed category, we will identify employees as being formal, and employers and own-account workers, as being informal. Thus, in a study of the informal aspects of the activity in a specific space, namely, a country, the consideration of its population and the above described groups should involve the economic activity of those groups and also the corresponding origin and the destination of their income.

Under the current System of National Accounts (SNA 2008), all of the population in a country is represented by households – one of the five institutional sectors identified by that system, the others being: financial and non-financial corporations, government and non-profit institutions serving households. In keeping with what was stated above, when all of the population of a country is studied within a SDM framework, its movements (expressed in numbers of human beings) can be represented in the form of a stock-flow matrix, which offers many possibilities for disaggregation, especially by age groups. In turn, the flows (expressed in currency units) representing households' production, consumption and income, can be studied within a SAM framework.

From what has just been said SAMs and SDMs, and their underlying approaches, allow for the study of a wide range of different aspects involved in the informal aspects of the countries' activity (and many other areas), that can be identified in accordance with the purposes of each specific study. Let's suppose that, in studying a possible increment of the informal aspects of the activity of countries, we wish to identify some macroeconomic effects of increases in the compensation of the informal labour on one hand, and, on the other hand, in either the incomes or the expenditures of the informal households. That possible increment can be seen both as an effort to correct a possible undervaluation of the activity of the household unincorporated enterprises by the national accounts, and also as an alternative to absorb a part of existing unemployment.

Given such a purpose, our attention necessarily has to be focused, on one hand, on those who are active and informally employed and, on the other hand, on the corresponding flows of income that are received and then spent by the group whose main source of income comes from the corresponding activity – the informal households. The following exposition, illustrated by the example of an application to Portugal, will show a simple possible way of using the tools presented above in a study with that particular purpose.

Table 11 shows a SDM for Portugal in 2009, with a disaggregation which allows for the identification of those who are informally employed, as described above, in columns and rows 4, 8 and 12, grouped by age levels. Because the numbers of the 15-24 age group, column and row 4, are insignificant, our attention will be focused on the other two groups.

Thus, when reading column 8 it can be seen that the opening stock of the informally employed, aged 25-64, measured in thousands of individuals, was 915 (8.6 % of the total population and 75.7 % of the total informally employed); of these, 3 either died or emigrated, 876 remained in the same situation throughout the year, 6 became unemployed and 30 moved to the informally employed 65 and over age group. Reading along the row (8) for the same group it can be seen that the closing stock was 878, which is composed of (approximately) 1 thousand individuals who moved from the informally employed 15-24 age group and (approximately) 876 who did not change their status.

In the case of the population aged 65 and over that is informally employed, from the reading of column 12, shows that it is represented by 293 thousands of individuals (2.8 % of the total population and 24.2 % of the total informally employed); of these, 37 either died or emigrated and 256 remained in the same situation throughout the year.

Table 11. SDM of Portugal in 2009 with population by age group, economic activity and market participation.

(Unit: 10³ individuals)

					Outside World	Population by age group, economic activity and market participation									
						0-14	15-24							Inactive	Total
							Active					Unemployed	Total		
							Employed			Total					
							Formal	Informal	Total						
					1	2	3	4		5		6			
Outside World					1		5				5	5		5	
Population by age group, economic activity and market participation	0-14				2	105	1 510								
	15-24	Active	Employed	Formal	3	10		362							
				Informal	4				0						
			Total				10			362					
			Unemployed		5			18		18	75				
			Total				10					456			
		Inactive			6		110					614			
		Total				10	110						1 070		
	25-64	Active	Employed	Formal	7	16		42							
				Informal	8				1						
				Total				16			43				
			Unemployed		9					3					
			Total				16					47			
		Inactive			10							100			
		Total				16							146		
	65&more	Active	Employed	Formal	11	0									
				Informal	12										
				Total				0							
			Unemployed		13										
			Total				0								
		Inactive			14										
		Total				0									
Opening Stock					15	10 623	1 625	423	1	424	83	508	714	1 221	

Source: Statistics Portugal (INE).

		Population by age group, economic activity and market participation														Closing Stock	
		25-64							65&more								
		Active					Inactive	Total	Active					Inactive	Total		
		Employed			Unem- ployed	Total			Employed			Unem- ployed	Total				
		Formal	Informal	Total					Formal	Informal	Total						
		7	8	Total	9	10	11	12	Total	13	14	15					
Outside World		1	11	3	13	9	22	3	25	4	37	41	0	42	39	81	10 638
Population by age group, economic activity and market participation	0-14		2														1 615
	15-24	Active	Empl.	Formal	3												373
				Informal	4										0		
				Total										373			
			Unemployed	5										94			
		Total													466		
	25-64	Active	Empl.	Formal	7												724
				Informal	8										1 190		
				Total											3 485		
			Unemployed	9											878		
		Total													4 363		
	65&more	Active	Empl.	Formal	11												434
				Informal	12											4 797	
				Total												1 156	
			Unemployed	13												5 952	
		Total														33	
	25-64	Active	Empl.	Formal	7												878
				Informal	8											4 363	
				Total												434	
			Unemployed	9												4 797	
		Total														1 156	
	65&more	Active	Empl.	Formal	11												5 952
				Informal	12												33
				Total													286
			Unemployed	13													319
		Total														1	
	25-64	Active	Empl.	Formal	7												320
Informal				8												1 561	
Total																1 772	
Unemployed			9													1 881	
Total																	
65&more	Active	Empl.	Formal	11													
			Informal	12													
			Total														
		Unemployed	13														
	Total																
25-64	Active	Empl.	Formal	7													
			Informal	8													
			Total														
		Unemployed	9														
	Total																
65&more	Active	Empl.	Formal	11													
			Informal	12													
			Total														
		Unemployed	13														
	Total																
Opening Stock		15	3533	915	4 448	343	4 791	1 133	5 924	33	293	326	0	326	1 527	1 853	

Source: Statistics Portugal (*INE*).

Table 12, shows the above presented SAM for Portugal in 2009, with a disaggregation that allows the identification of the flows of income that are received and spent by informal households, through their current account, as well as, the compensation of informal labour (employers and own-account workers).

Thus, in row and column 4 the aggregate factors income related to informal labour can be seen, i.e. the above referred gross mixed income, which amounts to 17,745 million Euros and represent 11.2% of total aggregate factors income. From the reading in column it is also possible to see that 81.3% of the gross mixed income (14,418 million Euros) is received by the informal households, being the remaining 18.7% being received by the formal households, as characterized above.

In turn, row and column 7 show, respectively, the receipts (or incomes) and the expenditures of the current account of the group of households whose main source of income is the compensation of informal labour⁶. Since the row and column totals are equal, they represent the aggregate income of that group, amounting to 30,601 million Euros, and the corresponding totals of receipts and expenditures. This amount represents 12.1% of the total aggregate income. Reading along the row, one can see that this income is derived from the compensation of labour and capital – 26,374 million Euros (86.2 %) – while the remaining part came from current transfers within households, from the rest of the world and from other institutional sectors – 4,227 million Euros (13.8%). Reading down the column, one can see that this income was mainly spent on final consumption – 15,935 million Euros (52.1%), transferred in the form of current transfers: within households, to the government (namely in the form of current taxes on income, wealth, etc), to the rest of the world and to other institutional sectors – 3,643 million Euros (11.9 %). In reading the column, one can also see that the part of the aggregate income that was not spent on final consumption or transferred, was saved, and this amounts to 11,023 million Euros (36.0%), which represent a significant proportion, especially when compared with that of the formal households: 2.1%.

⁶ For a better understanding of the following reading, see Santos (2013) – Section 4.

Table 12⁷: SAM for Portugal in 2009, with disaggregated factors of production, the (domestic) institutions' current and capital account, and formal and informal labour and households

(Unit: 10⁶ Euros)

Outlays (expenditures)				PRODUCTION						
				PRODUCTS	ACTIVITIES	FACTORS				
						Labour		Capital	Total	
						Formal	Informal			
Incomes (receipts)				1	2	3	4	5		
PRODUCTION	PRODUCTS			1	0	162 661	0	0	0	0
	ACTIVITIES			2	311 365	0	0	0	0	
	FACTORS	Labour	Formal	3	0	85 888	0	0	0	0
			Informal	4	0	17 745	0	0	0	0
		Capital		5	0	45 770	0	0	0	0
		Total				0	149 403	0	0	0
INSTITUTIONS	CURRENT ACCOUNT	Households (by source of income)	Formal	6	0	0	81 724	3 327	8 591	93 641
			Informal	7	0	0	4 033	14 418	7 922	26 374
			Total		0	0	85 757	17 745	16 513	120 015
		Enterprises (nonfinancial corporations)		8	0	0	0	0	14 615	14 615
		Financial corporations		9	0	0	0	0	5 990	5 990
		Government		10	19 694	522	0	0	- 34	- 34
		NonProfitInstitutionsServingHouseholds(NPISH)		11	0	0	0	0	837	837
		Total			19 694	522	85 757	17 745	37 921	141 423
	CAPITAL ACCOUNT	Households		12	0	0	0	0	0	0
		Enterprises (nonfinancial corporations)		13	0	0	0	0	0	0
		Financial corporations		14	0	0	0	0	0	0
		Government		15	0	0	0	0	0	0
		NonProfitInstitutionsServingHouseholds(NPISH)		16	0	0	0	0	0	0
		Total			0	0	0	0	0	0
		FINANCIAL ACCOUNT		17	0	0	0	0	0	0
	REST OF THE WORLD			18	59 823	- 1 222	370	0	16 649	17 019
	TOTAL					390 882	311 365	86 127	17 745	54 571

Sources: Statistics Portugal (*INE*); Portuguese Central Bank (*Banco de Portugal*).

⁷ This table is Table 3 showing the other factors' account disaggregated by informal labour and capital (rows and columns 4 and 5) and households' current account disaggregated by main source of income (rows and columns 6 and 7), represented in italic font. In this disaggregation the data that could not be taken from the integrated economic accounts, are in italic font and were estimated, adopting the same structure of the same account in the SAM worked upon in Santos (2009).

Table 12 (continued): SAM for Portugal in 2009, with disaggregated factors of production, the (domestic) institutions' current and capital account, and formal and informal labour and households

(Unit: 10⁶ Euros)

Outlays (expenditures)				INSTITUTIONS									
				CURRENT ACCOUNT									
				Households (by main source of income)			Enterprises (nonfinancial corporations)	Financial corporations	Government	NonProfitInsti- tutionsServing Households (NPISH)	Total		
				Formal	Informal	Total							
Incomes (receipts)				6	7		8	9	10	11			
PRODUCTION	PRODUCTS			1	90 271	15 935	106 206	0	0	37 160	3 568	146 934	
	ACTIVITIES			2	0	0	0	0	0	0	0		
	FACTORS	Labour	Formal	3	0	0	0	0	0	0	0	0	
			Informal	4	0	0	0	0	0	0	0	0	
		Capital			5	0	0	0	0	0	0	0	
		Total				0	0	0	0	0	0	0	
INSTITUTIONS	CURRENT ACCOUNT	Household s (by ..source of income)	Formal	6	499	155	655	1 662	4 855	26 330	86	33 588	
			Informal	7	112	35	146	168	370	2 668	9	3 361	
			Total				611	190	801	1 830	5 226	28 998	95
		Enterprises (nonfinancial corporations)			8	1 663	167	1 830	0	613	171	0	2 613
		Financial corporations			9	4 734	555	5 289	519	131	42	32	6 013
		Government			10	28 838	2 386	31 224	5 684	671	8	22	37 610
		NonProfitInstitutionsSer- vingHouseholds(NPISH)			11	259	65	324	154	50	1 997	0	2 525
		Total				36 105	3 363	39 468	8 187	6 690	31 215	150	85 711
	CAPITAL ACCOUNT	Households			12	2 705	11 023	13 728	0	0	0	0	13 728
		Enterprises (nonfinancial corporations)			13	0	0	0	8 903	0	0	0	8 903
		Financial corporations			14	0	0	0	0	5 283	0	0	5 283
		Government			15	0	0	0	0	0	- 11 695	0	- 11 695
		NonProfitInstitutionsSer- vingHouseholds(NPISH)			16	0	0	0	0	0	0	- 354	- 354
		Total				2 705	11 023	13 728	8 903	5 283	- 11 695	- 354	15 865
	FINANCIAL ACCOUNT			17	0	0	0	0	0	0	0	0	0
	REST OF THE WORLD				18	1 065	280	1 345	240	110	1 726	0	3 421
TOTAL					130 146	30 601	160 747	17 331	12 082	58 407	3 363	251 931	

Table 12 (continued): SAM for Portugal in 2009, with disaggregated factors of production, the (domestic) institutions' current and capital account, and formal and informal labour and households

(Unit: 10⁶ Euros)

Outlays (expenditures) <			
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As was seen in Subsection 3.1.3, aggregates, indicators and balancing items, representative of the macroeconomic level of the activity of the Portuguese economy in 2009, can be calculated from the SAMs presented in Tables 3 and 12. This is the case with what is normally considered to be the main macroeconomic aggregate - Gross Domestic Product at market prices (GDP_{pm}), which amounts to 168,504 million Euros. Since our SAM does not identify the institutional sectors in the production

accounts, the part corresponding to our group of study cannot be identified in that amount, although such a calculation is possible in the case of both Gross National Income and Disposable Income. Therefore, in the case of total Gross National Income, which has an amount of 161,639 million Euros, the share of informal households was 16.3%, while in the case of total Disposable Income, with an amount of 162,800 million Euros, the share of informal households was 16.6%.

In line with the above-mentioned purpose, for a better study of changes resulting from the increment of the informal aspects of the activity of countries, three scenarios will be presented: scenario A, involving an increase in gross mixed income (the total compensation of the informal labour); scenario B involving an increase in the part of the gross national income relating to the compensation of informal labour received by informal households; and scenario C, involving an increase in final consumption of informal households. The numerical SDM and SAM, presented in Tables 11 and 12, enable the identification of those changes. Algebraic SAMs, representing accounting multipliers (as described in Subsection 3.2) will enable the quantification of the macroeconomic effects of those increases, which will be summarised in the form of the changes occurring in the three above-mentioned macroeconomic aggregates: GDP_{pm} , Gross National Income and Disposable Income, as shown in Table 13.

In scenario A, our attention was focused, on one hand, on cell (4,2) of the SAM, which represents the gross mixed income, or the total compensation of the informal labour, amounting to 17,745 million Euros, and, on the other hand, on the sum of the totals of columns 4, 8 and 12 of the SDM, which represent the opening stock of the informally employed, amounting to 1,209 thousand individuals. An increase of 20% was then applied to the informally employed, who became 1,451 thousand individuals. Assuming that the gross mixed income *per* informally employed remained the same, the new total amount in cell (4,2) of the SAM became 21,294 million Euros, which represents an increase of 3,549 million Euros in the total compensation of informal labour, or gross mixed income.

In scenarios B and C, increases of 20% were applied, respectively, to the part of the gross national income relating to the compensation of informal labour, received by informal households and to the final consumption of the informal households. That represent increases of 2,884 million Euros in SAM's cell (7,4), in the former case, and of 3,187 million Euros in SAM's cell (1,7), in the latter case.

Following the Subsection 3.2 description and considering as exogenous the accounts whose outlays are affected by the increases in each scenario, as well as the financial and the rest of the world accounts, accounting multipliers were calculated from the SAM for Portugal in 2009. The effects of such increases were materialized in "new" x vectors, after the X matrices have been recalculated with

the new amounts of the above mentioned cells. In each of the three scenarios, from equation (7), a “new” y_n vector was determined and the rest of the “new” SAM was calculated considering equations (5) and (10). Table 13 shows the results, summarized by the changes in the macroeconomic aggregates.

Table 13. Percentage changes in macroeconomic aggregates in the three scenarios of possible increases in informal aspects of the activity of Portugal in 2009

		Scenario A	Scenario B	Scenario C
Gross Domestic Product (GDP) at market prices - Total		2.23	3.64	3.10
Gross National Income (GNI)	Total	2.33	4.88	2.98
	Informal Households	10.93	12.41	2.95
Disposable Income (DI)	Total	2.27	4.76	2.90
	Informal Households	9.55	11.11	3.22

Source: Own calculations.

Thus, the effects of an increase in gross mixed income (scenario A) were felt mainly at the level of the part of informal households in GNI and in DI. The totals of those aggregates, as well as, that of GDP, felt much lower or very identical effects.

In turn, the effects of an increase in compensation of informal labour received by informal households (scenario B) were felt in an identical form as the previous, but with higher impacts.

The effects of an increase in the final consumption of informal households (scenario C) were felt in a more undifferentiated manner in the selected aggregates, although in terms of totals they are higher than those verified with an increase in gross mixed income.

As far as the algebraic version of SAM used in the construction of the above scenarios is concerned, the accounting multipliers are based on assumptions that limit the results and the subsequent analysis of the constructed scenarios, as shown by Santos (2012). However, this methodology is very simple to apply and, from the author’s point of view, it represents a good way of exemplifying the aspects that were aimed to be highlighted in this paper. On the other hand, some types of algebraic versions of the SDM could also have been adopted, together (or not) with the SAM, but that is left for the next opportunity.

Much work can be undertaken with SAM and SDM-based approaches in studies in this, and many other different areas.

Using a SAM-based approach, a study carried out with the current, capital and financial accounts of informal households, for instance, would make it possible to conduct other studies in the area of

microfinance, namely about the role played by microcredit in the activity of that group and in the generation of its income and that of the whole economy. Such a study could be complemented and improved by also using a SDM-based approach, from which the behaviour of the stocks and flows of the part of the population linked to the owners of household unincorporated enterprises could be introduced.

6. Summary and concluding remarks

The Social Accounting Matrix (SAM) and the Socio-Demographic Matrix (SDM) are tools that can be used for studying the activity of countries both empirically and theoretically, depending on whether they are presented in a numerical or algebraic version. These are the so-called SAM-based and SDM-based approaches for studying (measuring and modelling) the activity of countries.

Using the example of a numerical version, the analysis of the activity of Portugal in 2009 was focussed on the study of the informal aspects of the activity of countries. Using an algebraic version of the SAM, the performance of a number of experiments allowed for the analysis of three scenarios that resulted from changes in that same reality. In that example, our attention was focused on household unincorporated enterprises. In the case of that population group, identified in SDM, our attention was focused on the so called ‘informally employed’, who are the owners’ household unincorporated enterprises, also known as employers and own-account workers, whether they operate with, or without, paid employees. In turn, in the SAM, our attention was focused, on one hand, on the flows of income generated by the informally employed, or the informal labour and, on the other hand, on the aggregate income that was received and expended by informal households – those whose main source of income is informal labour.

With our working tools, for the year being studied, it was possible to quantify the flows of the population of the country, by age groups and the corresponding participation in the labour market and in the supply side of goods and services market. On the other hand, for those groups (not by age), it was also possible to identify the amounts and the underlying structures of the corresponding generated, received and expended income. From the three scenarios that were experimented some macroeconomic effects of possible increments of the informal aspects of the activity of Portugal in 2009 were identified. Those increments were understood both to be an effort to correct a possible undervaluation of the informal aspects of the activity of the studied country, and as an alternative to absorb a part of the existing unemployment.

Our experiments involved increases of 20%: in the number of the informally employed (informal labour) and in the corresponding generated income - scenario A; in the part of the gross national

income relating to the compensation of informal labour received by informal households - scenario B; and in the final consumption of informal households - scenario C.

The effects of those increases were summarised outside the matrix format through the quantification of changes in the GDP_{pm}, Gross National Income and Disposable Income. Greater changes, either in totals, or the parts corresponding to informal households, highlight the impact in scenario B. The benefits of scenarios A and C are greater for the parts corresponding to the informal households in the former, and for the total economy in the latter.

Criticisms can be made, not only of the way in which the above experiments were performed, but also of the constraints imposed by the accounting multipliers (SAM-based model). This was, however, just a simple example of what can be done with the working tools of the SAM and the SDM. The importance of the informal aspects of the activity of countries varies from country to country; however, such aspects should not be neglected in those countries where the market output and monetary economic activity are increasing, or in countries that are largely dependent on the market but have high rates of unemployment and high levels of taxation and bureaucracy for registered enterprises, such as Portugal. The assessment of the importance of these informal aspects is only possible if they are included in the whole activity of those countries, using, for instance, both a SAM and a SDM. In such a case, the national statistics offices should pay special attention to these aspects, in order to produce meaningful information.

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